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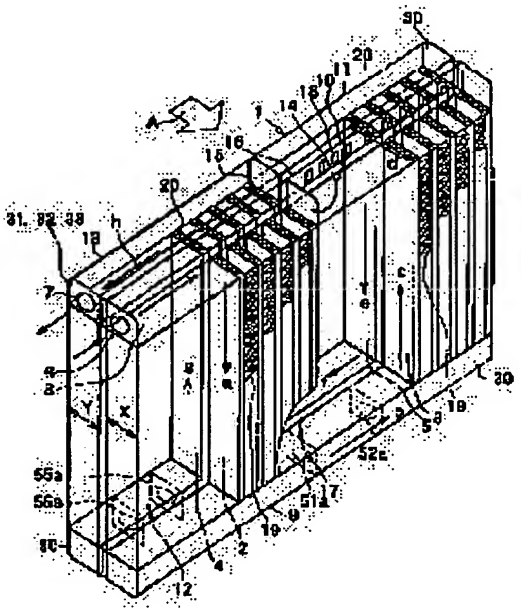
(54) REFRIGERANT EVAPORATOR

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain an evaporator comprising tubes and tank parts arranged in even rows in the flowing direction of external fluid such that refrigerant flows through the tubes and tank parts while snaking in which refrigerant inlet and outlet can be disposed on one end side in the direction orthogonal to the air flow in the tank while making uniform the temperature distribution of air delivered from the evaporator.
SOLUTION: A refrigerant passage is constructed such that refrigerant entering from a refrigerant inlet 6 passes through a heat exchanging section X disposed on the upstream side (or downstream side) in the flowing direction A of external fluid thence through an adjacent heat exchanging section Y to reach a refrigerant outlet 7 so that the refrigerant inlet and outlet 6, 7 can be disposed on one end side in the direction orthogonal to the air flow. The tank part for distributing refrigerant is provided with holes 51a-56a for throttling the refrigerant channel so that distribution of refrigeration in the tube can be set arbitrarily.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] While carrying out a refrigerant flow direction up and down and carrying out the parallel arrangement of many tubes (2-5) for pouring a refrigerant in the flow direction (A) and the rectangular direction of an external fluid Two or more trains arrangement of this tube (2-5) is carried out in the flow direction (A) of said external fluid. The tank section (8-13) which gather distribution of the refrigerant to said tube (2-5), or the refrigerant from said tube (2-5) To the vertical both ends of said tube (2-5), two or more trains arrangement is carried out at the flow direction (A) of said external fluid corresponding to the tube (2-5) of said two or more trains. A refrigerant inlet port (6) is arranged in said tank section (8-10) arranged to either the upstream of the flow direction (A) of said external fluid, and the downstream. The upstream of the flow direction (A) of said external fluid and the downstream either in the refrigerant passage which arranges a refrigerant outlet (7) in said tank section (11-13) arranged on another side, and is formed in said tube (2-5) and said tank section (8-13) While a refrigerant turns in the flow direction (A) and the rectangular direction of said external fluid It constitutes so that this turn direction may turn into hard flow in said refrigerant passage of the upstream of the flow direction (A) of said external fluid, and said refrigerant passage of the downstream. After a refrigerant passes through said all refrigerant passage of the train which has arranged said refrigerant inlet port (6), It constitutes so that it may pass through said refrigerant passage of the train which adjoins the flow direction (A) of an external fluid in order and said refrigerant outlet (7) may be reached. The refrigerant evaporator characterized by forming the converging section (51a-56a) which extracts said refrigerant passage to said tank section (9 12) arranged to the lower limit side of said tube (2-5).
[Claim 2] The refrigerant evaporator according to claim 1 characterized by having arranged said refrigerant inlet port (6) and the refrigerant outlet (7) at the edge of one side of the flow direction (A) of an external fluid, and the rectangular direction in said tank section (11-13).
[Claim 3] The refrigerant evaporator according to claim 1 or 2 characterized by arranging two or more free passage holes (18) which open this tank section (8-13) for free passage to the bridgewall (16 17) which divides between the tank sections (8-13) which adjoin the flow direction (A) of said external fluid in the flow direction (A) and the rectangular direction of said external fluid.
[Claim 4] The opening area of said converging section (51a-53a) formed in the tank section (9) of the refrigerant flow upstream in claim 1 thru/or the refrigerant evaporator of any one publication of three among said tank sections (9 12) arranged to the lower limit side of said tube (2-5) The refrigerant evaporator characterized by making it smaller than the opening area of said converging section (54a-56a) formed in the tank section (12) of the refrigerant flow downstream among said tank sections (9 12) arranged to the lower limit side of said tube (2-5).
[Claim 5] In said tank section (9 12) arranged to the lower limit side of said tube (2-5) the set section (9a, 12a) of a downward flow refrigerant, and the distribution section (9b --) of an upward flow refrigerant 12b forms -- having -- said set section (9a, 12a) and said distribution section (9b --) Claim 1 characterized by having opened predetermined spacing towards the refrigerant flow downstream near the boundary section with 12b, and forming two or more said

converging sections (51a-53a, 54a-56a) thru/or the refrigerant evaporator of any one publication of four.
[Claim 6] The refrigerant evaporator characterized by the refrigerant flow downstream making small opening area of two or more of said converging sections (51a-53a, 54a-56a) in a refrigerant evaporator according to claim 5.
[Claim 7] Claim 1 characterized by joining them to one after forming said tube (2-5) and said tank section (8-13) with another object thru/or the refrigerant evaporator of any one publication of six.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention is used for the air conditioner for cars about the refrigerant evaporator which evaporates the refrigerant of a refrigerating cycle, for example, is suitable.
[0002]
[Description of the Prior Art] In the utility model registration No. 2518259 official report, the refrigerant evaporator with the refrigerant passage configuration shown in drawing 21 is proposed. The tube 100 equipped with two refrigerant paths 100a and 100b parallel to the interior in this conventional refrigerant evaporator 1 as shown in drawing 22 , While having the 1st and 2nd tank 101 and 102 formed independently [this tube 100] and making one refrigerant path 100a in a tube 100, and the 1st tank 101 open for free passage He is trying to make refrigerant path 100b of another side in a tube 100, and the 2nd tank 102 open for free passage. Moreover, in the 1st tank 101 arranged at the air flow A upstream, while forming a dashboard (not shown) in the longitudinal direction pars intermedia, dividing into inlet-port tank section 101a which distributes a refrigerant for the inside of the 1st tank 101, and outlet tank section 101b which performs the set of a refrigerant and establishing the refrigerant inlet port 103 in inlet-port tank section 101a, the refrigerant outlet 104 is formed at outlet tank section 101b.
[0003] In the evaporator 1 of such a configuration, a refrigerant flows the interior according to the following path. That is, in drawing 21 , from the refrigerant inlet port 103 arranged at the air flow A upstream, a refrigerant goes into inlet-port tank section 101a of the 1st tank 101, and goes up windward refrigerant path ** in a tube 100. Next, after a refrigerant makes a U-turn in the upper part of a tube 100, it descends leeward side refrigerant path ** in a tube 100, and goes into the 2nd tank 102. Next, a refrigerant goes up leeward side refrigerant path ** in the tube 100 which flows the inside of the 2nd tank 102 on left-hand side by drawing 21 , and is located in left-hand side by drawing 21 from here. Next, after a refrigerant makes a U-turn in the upper part of a tube 100, it descends windward refrigerant path ** in a tube 100, goes into outlet tank section 101b of the 1st tank 101, it flows to the refrigerant outlet 104 arranged further at the air flow A upstream, and flows into the evaporator exterior.
[0004] And although liquid cooling intermediation mainly contributes to cooling of air among vapor-liquid 2 phase refrigerants In case a vapor-liquid 2 phase refrigerant flows the inside of the 2nd tank 102 toward the left-hand side of drawing 21 , in order for liquid cooling intermediation to tend to flow to a back side (drawing 21 left-hand side) according to inertia rather than a gas refrigerant in the evaporator 1 of such a configuration, The rate of liquid cooling intermediation of the left-hand side of drawing 21 will become high, and, as for the refrigerant which flows refrigerant path ** in a tube 100, evaporator blow-off air temperature will become an ununiformity.
[0005] Then, he equalizes distribution of the liquid cooling intermediation which flows into refrigerant path **, and is trying to equalize evaporator blow-off air temperature over the whole region of an evaporator 1 in the above-mentioned conventional refrigerant evaporator 1 by preparing a diaphragm in the tank circles which perform left-hand side refrigerant distribution by

drawing 21 among the 2nd tank 102, and restricting the amount of the liquid cooling intermediation which flows to the back side of the 2nd tank 102.
[0006]
[Problem(s) to be Solved by the Invention] However, although liquid cooling intermediation exists comparatively mostly by right-hand side refrigerant path ** and ** part by drawing 21 R> 1 with the above-mentioned conventional refrigerant evaporator 1 when there are few refrigerant flow rates, the refrigerant is almost gasified by left-hand side refrigerant path ** and ** part by drawing 21 . Therefore, the air which passes along refrigerant path ** and ** side becomes that it is hard to be cooled, and when there are few refrigerant flow rates, it has the problem that the temperature gradient of the air which passes along refrigerant path ** and ** side, and the air which passes along refrigerant path ** and ** side will become large.
[0007] This invention was made in view of the point describing above, and arranges the tank section to the vertical both ends of a tube, and two or more trains arrangement of this tube and the tank section is carried out in the flow direction of an external fluid, and it aims at attaining equalization of evaporator blow-off air-temperature distribution in the evaporator with which it was made for a refrigerant to flow, moving these tubes and tank circles in a zigzag direction.
[0008]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, in invention according to claim 1 While carrying out a refrigerant flow direction up and down and carrying out the parallel arrangement of many tubes (2-5) for pouring a refrigerant in the flow direction (A) and the rectangular direction of an external fluid Two or more trains arrangement of this tube (2-5) is carried out in the flow direction (A) of an external fluid. The tank section (8-13) which gather distribution of the refrigerant to a tube (2-5), or the refrigerant from a tube (2-5) To the vertical both ends of a tube (2-5), two or more trains arrangement is carried out at the flow direction (A) of an external fluid corresponding to the tube (2-5) of two or more trains. A refrigerant inlet port (6) is arranged in the tank section (8-10) arranged to either the upstream of the flow direction (A) of an external fluid, and the downstream. The upstream of the flow direction (A) of an external fluid and the downstream either in the refrigerant passage which arranges a refrigerant outlet (7) in the tank section (11-13) arranged on another side, and is formed in a tube (2-5) and the tank section (8-13) While a refrigerant turns in the flow direction (A) and the rectangular direction of an external fluid It constitutes so that this turn direction may turn into hard flow in the refrigerant passage of the upstream of the flow direction (A) of an external fluid, and the refrigerant passage of the downstream. After a refrigerant passes through all the refrigerant passage of the train which has arranged the refrigerant inlet port (6), It constitutes so that it may pass through the refrigerant passage of the train which adjoins the flow direction (A) of an external fluid in order and a refrigerant outlet (7) may be reached, and it is characterized by forming the converging section (51a-56a) which extracts refrigerant passage to the tank section (9 12) arranged to the lower limit side of a tube (2-5).
[0009] According to this, the turn direction is made into hard flow in the refrigerant passage of the upstream of the flow direction (A) of an external fluid, and the refrigerant passage of the downstream. By having constituted so that the refrigerant which passed through all the refrigerant passage of the train which has arranged the refrigerant inlet port (6) might pass through the refrigerant passage of the train which adjoins the flow direction (A) of an external fluid in order and might reach a refrigerant outlet (7) The refrigerant passage by the side of the refrigerant inlet port (6) where liquid cooling intermediation exists comparatively mostly, and the refrigerant passage by the side of a refrigerant outlet (7) with many gas refrigerants become a serial in the flow direction (A) of an external fluid. Therefore, even when there are few refrigerant flow rates, evaporator blow-off air-temperature distribution can be made into homogeneity.
[0010] Moreover, it is possible to set refrigerant distribution of the tube group in which a refrigerant goes up as arbitration with a converging section (51a-56a). By the tube group which follows, for example, laps in the flow direction (A) of an external fluid, when distribution of a refrigerant is uneven, by making into refrigerant distribution and the reverse of other tube groups refrigerant distribution of the tube group in which a refrigerant goes up, the ununiformity of refrigerant distribution can be offset and much more equalization of evaporator blow-off air-

temperature distribution can be attained.
[0011] In invention according to claim 2, it is characterized by having arranged the refrigerant inlet port (6) and the refrigerant outlet (7) at the edge of one side of the flow direction (A) of an external fluid, and the rectangular direction in the tank section (11-13).
[0012] By the way, in the conventional refrigerant evaporator 1, the refrigerant inlet port 103 and the refrigerant outlet 104 are arranged in the 1st tank 101 in the pars intermedia of the evaporator cross direction, and are located in the air duct within an air-conditioning case. Therefore, the end of the auxiliary piping for connection is connected to the refrigerant entrances 103 and 104, and he makes the other end of the auxiliary piping for connection project out of an air-conditioning case (edge side of the evaporator cross direction), and is trying to connect this auxiliary piping for connection, and external refrigerant piping. Therefore, the auxiliary piping for connection must be prepared and there is a problem which is the auxiliary piping for connection of carrying out a part cost rise.
[0013] On the other hand, according to invention according to claim 2, since a refrigerant inlet port (6) and a refrigerant outlet (7) are both arranged to the end side (edge side of the evaporator cross direction) of the flow direction (A) of an external fluid, and the rectangular direction, the auxiliary piping for connection can become unnecessary, can attain simplification of an evaporator configuration, and can reduce a manufacturing cost.
[0014] It is characterized by arranging two or more free passage holes (18) which open this tank section (8-13) for free passage to the bridgewall (16 17) which divides with invention according to claim 3 between the tank sections (8-13) which adjoin the flow direction (A) of an external fluid in the flow direction (A) and the rectangular direction of an external fluid.
[0015] According to this, since the free passage hole (18) for obtaining the turn configuration of refrigerant flow can be constituted very easily using bridgewall (16 17) itself, it is not necessary to add a side refrigerant path on an evaporator side face specially. Consequently, the component part for a side refrigerant path becomes unnecessary, and only the part can attain simplification of an evaporator configuration and can reduce a manufacturing cost.
[0016] And refrigerant distribution of the tube group in the refrigerant flow downstream of a free passage hole (18) can be set as arbitration by setting up suitably each opening area, arrangement, etc. of the prepared free passage hole (18). Therefore, by the tube group which laps in the flow direction (A) of an external fluid, when distribution of a refrigerant is uneven, by making refrigerant distribution of the tube group in the refrigerant flow downstream of a free passage hole (18) into refrigerant distribution and the reverse of other tube groups, the ununiformity of refrigerant distribution can be offset and equalization of evaporator blow-off air-temperature distribution can be attained.
[0017] The refrigerant distribution in a tube (2-5) can be set up still more finely by opening predetermined spacing towards the refrigerant flow downstream near the boundary section of the set section (9a, 12a) of a downward flow refrigerant and the distribution section (9b, 12b) of an upward flow refrigerant in the bottom tank section (9 12), and forming two or more converging sections (51a-53a) like invention according to claim 5.
[0018] If they are joined to one like invention according to claim 7 after forming a tube (2-5) and the tank section (8-13) with another object, the thinning of the board thickness of a tube (2-5) can be carried out, and improvement in the heat exchange engine performance and a miniaturization can be attained by detailed-ization of the heat exchange section. And in the tank section (8-13) which is not related to the heat exchange engine performance, a tube (2-5) can set up the board thickness uniquely from a viewpoint of reservation on the strength independently, and the need reinforcement of the tank section (8-13) can be secured easily.
[0019] In addition, the sign in the parenthesis of each above-mentioned means shows correspondence relation with the concrete means given in an operation gestalt mentioned later.
[0020]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on drawing.
(The 1st operation gestalt) Drawing 1 shows the 1st operation gestalt which applied this invention to the refrigerant evaporator in the refrigerating cycle of the air conditioner for

automobiles, and shows the outline of the whole configuration of an evaporator. An evaporator 1 carries out the vertical direction of drawing 1 up and down, and is installed in the air-conditioning unit case of the air conditioner for automobiles which is not illustrated. Air is ventilated in the direction of arrow-head A by the blower which is not illustrated to an evaporator 1, and this ventilation air (external fluid) and refrigerant carry out heat exchange.

[0021] The evaporator 1 has the tubes 2, 3, 4, and 5 arranged two trains at air flow direction A. These tubes 2-5 are flat tubes which constitute a cross-section flat-like refrigerant path altogether. And this parallel arrangement of many tubes 2-5 is carried out in air flow direction A and the rectangular direction, respectively. Here, the 1st tube 2 and 3 of the air downstream constitutes the refrigerant path of the refrigerant entrance-side heat exchange section X, and the 2nd tube 4 and 5 of the air upstream constitutes the refrigerant path of the refrigerant entrance-side heat exchange section Y.

[0022] The vapor-liquid 2 phase refrigerant of low-temperature low voltage which the refrigerant inlet port 6 was decompressed by the temperature actuation type expansion valve (reduced pressure means) which a refrigerating cycle does not illustrate, and expanded flows. Moreover, the refrigerant outlet 7 is for making the gas refrigerant which was connected to compressor inhalation piping which is not illustrated and evaporated with the evaporator 1 flow back to a compressor inlet side. Moreover, in this example, the refrigerant inlet port 6 and the refrigerant outlet 7 are arranged in the upper part on the left-hand side of an evaporator 1, and are opening the refrigerant inlet port 6 for free passage in the entrance-side tank section 8 located in upside left-hand side. Moreover, the refrigerant outlet 7 is open for free passage in the outlet side tank section 13 located in upside left-hand side.

[0023] If the tank sections 8-13 of an evaporator 1 are explained concretely, each tank sections gather distribution of the refrigerant to tubes 2-5, or the refrigerant from tubes 2-5, and are arranged two trains at air flow direction A corresponding to the 1st tube 2 and 3 and the 2nd tube 4 and 5. That is, the entrance-side tank sections 8-10 are located in the air flow downstream, and the outlet side tank sections 11-13 are located in the air flow upstream.

[0024] And it is divided by the diaphragm 14 between the upside entrance-side tank sections 8 and 10, and is divided by the diaphragm 15 between the upside outlet side tank sections 11 and 13. On the other hand, the lower entrance-side tank section 9 and the lower outlet side tank section 12 are open for free passage without a partition as one passage covering the crosswise overall length of an evaporator 1.

[0025] In the refrigerant entrance-side heat exchange section X, the end section (upper limit section) of the left-hand side tube 2 is open for free passage in the upside entrance-side tank section 8, and is opening the other end (lower limit section) for free passage in the lower entrance-side tank section 9. Similarly, the end section (upper limit section) of the right-hand side tube 3 is open for free passage in the upside entrance-side tank section 10, and is opening the other end (lower limit section) for free passage in the lower entrance-side tank section 9. Moreover, in the refrigerant outlet side heat exchange section Y, the end section (upper limit section) of the left-hand side tube 4 is open for free passage in the upside outlet side tank section 13, and is opening the other end (lower limit section) for free passage in the lower outlet side tank section 12. Similarly, the end section (upper limit section) of the right-hand side tube 5 is open for free passage in the upside outlet side tank section 11, and is opening the other end (lower limit section) for free passage in the lower outlet side tank section 12.

[0026] By the way, among the upside tank sections 10 and 11 and among the lower tank sections 9 and 12, the bridgewalls 16 and 17 all prolonged covering the crosswise overall length of an evaporator 1 are formed between the tank sections 8 and 13 of the upper part which adjoins in air flow direction A. These bridgewalls 16 and 17 are formed in the tank sections 8-13 and one so that it may mention later.

[0027] However, the free passage hole 18 which opens the tank sections 10 and 11 for free passage is established in the part of the right-hand side into which it divides among the upside bridgewalls 16 between the tank sections 10 and 11. that by which two or more these free passage holes 18 are formed in air flow direction A and the rectangular direction (cross direction of an evaporator 1) — it is — more — concrete — arrangement of tubes 3 and 5 —

respectively — corresponding — these tubes 3 and 5 and same number ****** — things are desirable because of the refrigerant distributivity improvement to each tube.
[0028] Here, the free passage hole 18 can pierce and process two or more coincidence into the metal sheet metal (aluminum etc.) which constitutes a bridgewall 16 by press working of sheet metal, and the configuration of the free passage hole 18 has the shape of a rectangle as shown in drawing 1 . Furthermore, the opening area and the array of the free passage hole 18 are set up so that the refrigerant distributivity to each tube may become the optimal.
[0029] The corrugated fin 19 fabricated by the wave is arranged between [of each tubes 2-5] mutual, and the corrugated fin 19 is joined to one by the flat side of each tubes 2-5. Moreover, the inner fin 20 fabricated by the wave is arranged inside each tubes 2-5, and while aiming at reinforcement of each tubes 2-5 by joining the wave-like crowning of this inner fin 20 to each tube internal surface, improvement in the engine performance by increase of a refrigerant side heating area is aimed at.
[0030] Moreover, drawing 2 shows the configuration of the lower entrance-side tank section 9 and the outlet side tank section 12, and in the lower entrance-side tank section 9, in order to set distribution of the liquid cooling intermediation to a tube 3 and 4 each part as arbitration, the 1st in_which the 1st - the 3rd converging section 51a-53a were formed - the 3rd throttle plate 51-53 are installed. The 1st throttle plate 51 is arranged in the lower entrance-side tank section 9 at the boundary section of sump-tank part 9a which gathers a refrigerant, and distribution tank part 9b which performs distribution of a refrigerant. Moreover, the 2nd and 3rd throttle plate 52 and 53 opens predetermined spacing in distribution tank part 9b of the lower entrance-side tank section 9, and is arranged.
[0031] Similarly, the 4th in_which the 4th - the 6th converging section 54a-56a were formed also in the lower outlet side tank section 12 - the 6th throttle plate 54-56 are installed. The 4th throttle plate 54 is arranged in the lower outlet side tank section 12 at the boundary section of sump-tank part 12a which gathers a refrigerant, and distribution tank part 12b which performs distribution of a refrigerant. Moreover, the 5th and 6th throttle plate 55 and 56 is arranged at distribution tank part 12b of the lower outlet side tank section 12.
[0032] Here, the 1st - the 6th restriction 51a-56a can be pierced and processed into the metal sheet metal (aluminum etc.) which constitutes throttle plates 51-56 by press working of sheet metal, and the configuration of restriction 51a-56a is a circle configuration as shown in drawing 2 .
[0033] In addition, it is joined to one by soldering that it seems that it mentions later, and drawing 1 and the evaporator 1 whole shown in 2 are **** with a group.
[0034] next , if an operation of the evaporator by the 1st operation gestalt be explain in the above-mentioned configuration , the vapor-liquid 2 phase refrigerant of low-temperature low voltage decompressed by the expansion valve which be illustrate be involve refrigerant inlet port 6 , but flow in the upper tank section 8 of the air downstream , it will be distribute to two or more tubes 2 , will flow a tube 2 below like an arrow head a , and will result in sump tank part 9a of the lower tank section 9 here . After that, after a refrigerant flows the inside of the lower tank section 9 to the distribution tank part 9b side like an arrow head b, it is distributed to two or more tubes 3, it flows this tube 3 upwards like an arrow head c, and flows in the upside tank section 10.
[0035] Next, a refrigerant passes through the free passage hole 18 which was able to be made in the bridgewall 16 like an arrow head d, shifts to the air upstream from the air downstream, and flows in the upper-tank section 11 of the air upstream. Next, a refrigerant is distributed to two or more tubes 5 from this upper-tank section 11, a tube 5 is flowed below like an arrow head e, and it flows into sump-tank part 12a of the lower-tank section 12.
[0036] Next, after a refrigerant flows the lower-tank section 12 to the distribution tank part 12b side like an arrow head f, it is distributed to two or more tubes 4, and it flows this tube 4 upwards like an arrow head g. The appropriate back, the refrigerants from a tube 4 gather within the upper-tank section 13, shift this upper-tank section 13 to left-hand side from right-hand side like an arrow head h, and flow out of the refrigerant outlet 7 into the exterior of an evaporator 1.

[0037] On the other hand, ventilation air (air-conditioning air) is ventilated in the direction of arrow-head A, and passes the opening section of the core section for heat exchange constituted with tubes 2-5 and the corrugated fin 19. In this case, when the refrigerant in a tube 2-5 carries out endoergic and evaporates from ventilation air, ventilation air is cooled, and it becomes cold blast, it blows off to the vehicle interior of a room, and the vehicle interior of a room is air-conditioned.
[0038] By the way, in the above-mentioned evaporator 1, since the refrigerant entrance-side heat exchange section X which consists of letter passage of meandering of the refrigerant entrance side shown by arrow-head a-c is arranged to the downstream of air flow direction A and the refrigerant outlet side heat exchange section Y which consists of letter passage of meandering of a refrigerant outlet side shown by arrow-head e-h is arranged to the upstream of air flow direction A, heat exchange of rectangular counterflow with the sufficient heat transfer engine performance can be performed between a refrigerant and air.
[0039] And the refrigerant passage before and behind an air flow direction can be connected, without needing a side refrigerant path, since it is directly open for free passage with the free passage hole 18 which opened in the bridgewall 16 between the tank sections 10 and 11 located before and after air flow direction A. Therefore, while being able to attain compaction of the whole evaporator configuration, pressure-loss reduction of the refrigerant passage of the whole evaporator can be aimed at. By pressure-loss reduction of this refrigerant passage, a refrigerant evaporation pressure can be reduced, and refrigerant evaporation temperature can be reduced, consequently the cooling engine performance of an evaporator can be improved.
[0040] Furthermore, in the above-mentioned evaporator 1, after the refrigerant which flows from the refrigerant inlet port 6 passes the refrigerant entrance-side heat exchange section X, by having constituted refrigerant passage, it can focus on the end side (the drawing 1 upper left section) of air flow direction A and the rectangular direction, and can arrange the refrigerant inlet port 6 and the refrigerant outlet 7 so that the refrigerant outlet side heat exchange section Y may be passed and the refrigerant outlet 7 may be reached. Therefore, since external refrigerant piping and the refrigerant entrances 6 and 7 besides an air-conditioning case are connectable by preparing opening in an air-conditioning case (not shown) corresponding to the location of the refrigerant entrances 6 and 7, the auxiliary piping for connection becomes unnecessary.
[0041] Moreover, in the above-mentioned evaporator 1, in order to attain equalization of evaporator blow-off air-temperature distribution, distribution with each tubes 2-5 of the refrigerant which flows into an evaporator 1 is set up as follows.
[0042] First, the refrigerant distribution of a tube 2 and a tube 4 located before and after air flow direction A is explained. First, when a refrigerant is distributed to a tube 2 from the upper-tank section 8, with gravity, generally liquid cooling intermediation flows in in the tube 2 of the part (drawing 1 left-hand side) near the refrigerant inlet-port section side of the upper-tank section 8 mostly, and, on the other hand, becomes the inclination for liquid cooling intermediation to be unable to flow easily in the tube 2 of a part (drawing 1 right-hand side) distant from the refrigerant inlet-port section. However, since it is before carrying out heat exchange of the refrigerant in the time of flowing into the upper-tank section 8 to air, liquid cooling intermediation fully flows also into the tube 2 of the part (drawing 1 right-hand side) by which the rate of liquid cooling intermediation is high, therefore distant from the refrigerant inlet-port section, and distribution of the liquid cooling intermediation in a tube 2 has become homogeneity in it comparatively.
[0043] Then, in the tube 4 located in the air flow upstream of a tube 2, it is adjusted by the 4th arranged at distribution tank part 12b - the 6th restriction 54a-56a so that the liquid cooling intermediation distribution in a tube 4 may become abbreviation homogeneity, so that it may next explain in full detail.
[0044] First, since liquid cooling intermediation flows in to a back side (drawing 1 left-hand side) mostly according to inertia when there are not the 4th - the 6th restriction 54a-56a, liquid cooling intermediation mainly flows, in the tube 4 of a near side, a gas refrigerant will mainly flow and, as for the tube 4 by the side of the back, liquid cooling intermediation distribution will become an ununiformity. In the above-mentioned evaporator 1, however, the refrigerant which

flows like an arrow head f the lower-tank section 12 In case 4th restriction 54a is passed first, the rate of flow is raised, in the location immediately after passage, a gas refrigerant and liquid cooling intermediation are stirred in 4th restriction 54a, both are mixed, and, therefore, a gas refrigerant and the refrigerant which liquid cooling intermediation mixed flow into the tube 4 of the part just behind 4th restriction 54a. the refrigerant which advanced toward the back side (drawing 1 left-hand side) further from here — the 5th throttle plate 55 — mainly — liquid cooling intermediation — **** stop ** — therefore, liquid cooling intermediation flows into the tube 4 of the part in front of the 5th throttle plate 55 mostly.

[0045] Moreover, in the location immediately after passing 5th restriction 55a, a gas refrigerant and liquid cooling intermediation are stirred, both are mixed, and, therefore, a vapor-liquid 2 phase refrigerant flows into the tube 4 of the part just behind 5th restriction 55a. Similarly, a vapor-liquid 2 phase refrigerant flows into the tube 4 of the part in front of the 6th throttle plate 56 according to a stirring operation in a location immediately after liquid cooling intermediation flows in mostly and passes 6th restriction 56a according to a **** stop operation.

[0046] And the opening area of the 4th - the 6th restriction 54a-56a, and by setting up suitably arrangement of the 6th of the 4th - throttle plates 54-56, it is possible to make liquid cooling intermediation distribution in a tube 4 into abbreviation homogeneity, therefore the temperature distribution of the air which passes the tube 2 located before and after air flow direction A and a tube 4 can be equalized.

[0047] In addition, drawing 3 takes out the refrigerant outlet side heat exchange section Y, it is the existence of the 4th - the 6th restriction 54a-56a, and it is what measured the blow-off air temperature of the tube 4 at the time of ventilating 27-degree C air, and the continuous line shows the result [those with restriction, and a broken line] without restriction. An extensive improvement (equalization) of blow-off air-temperature distribution is possible by equalization of the liquid cooling intermediation distribution by restriction 54a-56a so that clearly from this drawing 3 .

[0048] Moreover, the whole region of the heat exchange sections X and Y is used by equalization of each liquid cooling intermediation distribution of each tubes 2-5 effective in heat exchange, and can gather heat exchange effectiveness by it. Moreover, by equalization of liquid cooling intermediation distribution of a tube 4, when a refrigerant flows into a tank 13 from a tube 4, it becomes easy to make gasification of a refrigerant complete exactly.

[0049] Next, the refrigerant distribution of a tube 3 and a tube 5 located before and after air flow direction A is explained. First, the 1st arranged at distribution tank part 9b - the 3rd restriction 51a-53a function as the 4th arranged at the above-mentioned distribution tank part 12b - the 6th restriction 54a-56a similarly, and they are adjusted so that the liquid cooling intermediation distribution in a tube 3 may become abbreviation homogeneity. And corresponding to the liquid cooling intermediation distribution in a tube 3 being adjusted to abbreviation homogeneity, two or more free passage holes 18 make opening area equal, and are arranged at equal spacing in air flow direction A and the rectangular direction so that the refrigerant distribution in a tube 5 may also become homogeneity. Therefore, the temperature distribution of the air which passes the tube 3 located before and after air flow direction A and a tube 5 can be equalized.

[0050] in addition, when the unevenness of the liquid cooling intermediation distribution in a tube 2 is large The opening area of the 4th arranged at distribution tank part 12b - the 6th restriction 54a-56a, and by setting up suitably arrangement of the 6th of the 4th - throttle plates 54-56 Liquid cooling intermediation distribution in a tube 4 can be made into the refrigerant distribution in a tube 2, and reverse, and the temperature distribution of the air which passes the tube 2 located before and after air flow direction A by it and a tube 4 can be equalized.

[0051] Moreover, when unevenness remains in the liquid cooling intermediation distribution in a tube 3, by setting up suitably the opening area of two or more free passage holes 18, and arrangement, the refrigerant distribution in a tube 5 can be adjusted and the temperature distribution of the air which passes the tube 3 located before and after air flow direction A and a tube 5 can be equalized.

[0052] Next, drawing 4 explains the desirable opening surface ratio of the 1st - the 6th restriction 51a-56a. Here, opening surface ratio is the value which broke the opening area of

each restriction 51a-56a by the cross section of the passage of the tank sections 9 and 12. Moreover, the air conditioning engine-performance ratio makes 100% the air conditioning engine performance (cooling engine performance of the ventilation air by the evaporator 1) when setting up the opening surface ratio of all the restriction 51a-56a the optimal. And by drawing 4 , the opening surface ratio of any one restriction is changed, and the opening surface ratio of other restriction shows the air conditioning engine-performance ratio at the time of setting it as an optimum value.

[0053] When the opening surface ratio of each restriction 51a-56a is larger than an optimum value, the air conditioning engine performance falls without acquiring the optimal refrigerant distribution, and when the opening surface ratio of each restriction 51a-56a is smaller than an optimum value, since pressure loss becomes large, on the other hand, the air conditioning engine performance falls.

[0054] according to drawing 4 — the optimum value of the opening surface ratio of each restriction 51a-56a — for 3rd restriction 53a, 4th restriction 54a is [1st restriction 51a / 2nd restriction 52a / 6th restriction 56a of 5th restriction 55a] about 46% about 65% about 80% about 20% about 35% about 46%.

[0055] And the optimal opening surface ratio of the 1st prepared in the entrance-side tank section 9 of the refrigerant flow upstream between the two lower tank sections 9 and 12 - the 3rd converging section 51a-53a, If the optimal opening surface ratio of the 4th prepared in the outlet side tank section 12 of the refrigerant flow downstream between the two lower tank sections 9 and 12 - the 6th converging section 54a-56a is compared The direction of the optimal opening surface ratio of the 1st - the 3rd converging section 51a-53a becomes smaller than the optimal opening surface ratio of the 4th - the 6th converging section 54a-56a.

[0056] Moreover, if the optimal opening surface ratio of the 1st - the 3rd converging section 51a-53a in the entrance-side tank section 9 of the upstream is compared, the refrigerant flow downstream will become small. Furthermore, if the optimal opening surface ratio of the 4th - the 6th converging section 54a-56a in the outlet side tank section 12 of the downstream is compared, the refrigerant flow downstream will become small.

[0057] In addition, although the 1st throttle plate 51 and the 4th throttle plate 54 have been arranged in the boundary section of the sump-tank parts 9a and 12a which gather a refrigerant, and the distribution tank parts 9b and 12b which perform distribution of a refrigerant If the 1st throttle plate 51 and the 4th throttle plate 54 are near the boundary section of the sump-tank parts 9a and 12a and the distribution tank parts 9b and 12b, the same effectiveness will be acquired even if a location shifts a little.

[0058] By the way, although there was a problem that the temperature gradient of the air which passes along refrigerant path ** and ** side, and the air which passes along refrigerant path ** and ** side will become large, in drawing 21 and the conventional refrigerant evaporator 1 shown in 22 when there were few refrigerant flow rates With this operation gestalt, since the refrigerant passage by the side of the refrigerant inlet port 6 where liquid cooling intermediation exists comparatively mostly, and the refrigerant passage by the side of the refrigerant outlet 7 with many gas refrigerants become a serial at flow direction A of an external fluid, even when there are few refrigerant flow rates, evaporator blow-off air-temperature distribution can be made into homogeneity.

[0059] moreover, in drawing 21 and the conventional refrigerant evaporator 1 shown in 22 In order for the refrigerant which went up leeward side refrigerant path ** to make a U-turn in the upper part and to flow into windward refrigerant path ** with the refrigerant part blanket-like voice of refrigerant path ** and abbreviation identitas, If distribution of the liquid cooling intermediation which flows into leeward side refrigerant path ** is not equalized enough, distribution of liquid cooling intermediation of windward refrigerant path ** will also become an ununiformity, and dispersion in evaporator blow-off air temperature will become very large. So, in order to equalize more distribution of the liquid cooling intermediation which flows into leeward side refrigerant path **, there is the need of preparing much diaphragms in the refrigerant distribution section of refrigerant path **, and performing fine adjustment, consequently the problem that the pressure loss of refrigerant passage becomes large arises.

[0060] On the other hand, with this operation gestalt, since restriction 51a-56a and the free passage hole 18 can adjust each liquid cooling intermediation distribution of each tubes 2-5 according to an individual, there is little need of preparing much diaphragms in a specific part and performing fine adjustment like the conventional evaporator, therefore it can lessen the increment in the pressure loss of refrigerant passage.
[0061] Next, the concrete configuration and the manufacture approach of an evaporator 1 by the 1st operation gestalt are explained. Drawing 5 illustrates the tank sections 8-13, and forms the upside tank sections 8, 10, 11, and 13 by bending the sheet metal material made from aluminum of one sheet. And the bridgewall 16 consists of the central bending sections. Similarly, when the lower tank sections 9 and 12 and a lower bridgewall 17 also bend the sheet metal material made from aluminum of one sheet, it forms. The board thickness of the sheet metal material made from aluminum secures the reinforcement of the tank section on which the big stress by refrigerant pressure acts as about 0.6mm as compared with a tube.
[0062] As an example of the concrete quality of the material of the above-mentioned aluminum sheet metal material, the clad of the wax material (A No. 4000 system) is carried out to a medial surface, and the single-clad material which allotted the core material (A No. 3000 system) to the lateral surface is used. In this case, corrosion resistance may be raised as sandwiches structure which prepared sacrifice corrosion material (for example, aluminum-1.5wt%Zn) in the lateral surface of a core material.
[0063] Next, drawing 6 (a) shows the cross-section configuration of tubes 2-5, and tubes 2-5 constitute the cross-section flat-like path configuration by bending the sheet metal material made from aluminum of one sheet. Here, the internal refrigerant path 21 in a tube 2-5 is divided into many small paths by junction of the wave crowning of the inner fin 20.
[0064] As an example of the concrete quality of the material of the sheet metal material made from aluminum of a tube, as shown in drawing 6 (b), the aluminum raise in basic wages material which formed the sacrifice corrosion material (for example, aluminum-1.5wt%Zn) 23 in the lateral surface of the core material 22 of A No. 3000 system can be used. The board thickness t of the sheet metal material made from aluminum of a tube can carry out thinning to about 0.25-0.4mm according to the reinforcement operation by the inner fin 20. Tube height h can be made low to about 1.75mm by the thinning of this tube board thickness t. The inner fin 20 consists of aluminum raise in basic wages material of A No. 3000 system.
[0065] And wax material (A No. 4000 system) is applied to a junction need part like drawing 6 (c) for junction on tubes 2-5 and the inner fin 20. That is, the paste-like wax material (A No. 4000 system) 24a and 24a is applied to the medial surface of the both ends of this tube sheet metal material 24 before bending processing of the sheet metal material 24 made from aluminum which constitutes tubes 2-5. Similarly, before incorporating the inner fin 20 in a tube, paste-like wax material (A No. 4000 system) 20a is applied to the wave crowning of the inner fin 20.
[0066] This wax material spreading can perform junction of the both-ends comrade of the tube sheet metal material 24, and junction in the internal surface of the tube sheet metal material 24, and the wave crowning of the inner fin 20 at the time of one soldering of the whole evaporator. In addition, if the single-clad material which carried out the clad of the wax material to the medial surface as the quality of the material of the tube sheet metal material 24 is used, the above-mentioned wax material spreading will become unnecessary. Moreover, it is good even if unnecessary [in wax material spreading in the wave crowning of the inner fin 20] using the double clad material which carried out the clad of the wax material to both sides as the quality of the material of the inner fin 20.
[0067] Next, drawing 7 is an example of the joint of the tank sections 8-13 and the both ends of tubes 2-5, and the tube insertion hole 26 where the both ends 25 of tubes 2-5 are inserted is made in the flat side of the tank sections 8-13. Here, in order to make easy insertion into the hole 26 of the both ends 25 of tubes 2-5, both ends 25 are formed in the configuration shown in drawing 8 .
[0068] That is, the edge limb 27 of the tube joint shown in drawing 6 (a) is deleted at the tube both ends 25, notch 27a is formed, and the tube both ends 25 are formed in an abbreviation ellipse-like configuration. Since this notch 27a plays the role of the positioning stopper when

inserting the both ends 25 of tubes 2-5 in the tube insertion hole 26 of the tank sections 8-13 as shown in drawing 8 (e), it becomes easy to tube insertion work it to the tank section. In addition, in drawing 8 (e), outline illustration only of the tank section of one side before and behind air flow direction A is carried out among the tank sections 8-13.

[0069] Here, the insertion hole 26 serves as a burring configuration which is the thing of the shape of an ellipse corresponding to the both ends 25 of tubes 2-5, and hammered out ellipse-like ****** 26a (refer to drawing 7) to the method side of the outside of a tank. Thereby, the tank sections 8-13 and tubes 2-5 are joinable using the wax material of the medial surface of the tank sections 8-13.

[0070] In addition, what is necessary is to apply wax material only to the both ends 25 of tubes 2-5 in the state of the tube simple substance, and just to join the tank sections 8-13 and tubes 2-5 using this wax material, when hammering out ****** 26a of the tube insertion hole 26 of the tank sections 8-13 to the tank inside like drawing 9 .

[0071] Drawing 10 is the corrugated fin (outer fin) 19 joined to the tube lateral surface, and has started well-known louver 19a aslant. After it forms 19 by the aluminum raise in basic wages material of this corrugated fin system of No.A3000 and it applies wax material 19b only to the wave crowning which is a junction (soldering) part with a tube, it carries out with [of the corrugated fin 19 and tubes 2-5] a group.

[0072] Drawing 11 illustrates the structure with a group of diaphragms 14 and 15, and two diaphragms 14 and 15 are really fabricated in this example by the plate 27 of one sheet for simplification with a group. As an example of the quality of the material of this plate 27 (diaphragms 14 and 15), the double clad material which carried out the clad of the wax material (A No. 4000 system) is used for both sides of a core material (A No. 3000 system).

[0073] Slit slot 27a which fits into the bridgewall 16 of tanks 11 and 13 and tanks 8 and 10 is formed in the plate 27. On the other hand, among tanks 11 and 13 and among tanks 8 and 10, the slit slots 28 and 29 for insertion of diaphragms 14 and 15 are formed, respectively. Fitting slit slot 27a into a bridgewall 16, by inserting diaphragms 14 and 15 in the slit slots 28 and 29, using the wax material of both sides of a plate 27, and the wax material of the tank inside, diaphragms 14 and 15 are soldered on tanks 10-13, and it divides between tanks 11 and 13 and between tanks 8 and 10, respectively. In addition, diaphragms 14 and 15 may be completely divided into two members, and, of course, you may solder with [above] a group.

[0074] Drawing 12 shows the covering device material 30 of tanks 8-13, and the covering device material 30 is arranged at other three places other than the part in which the refrigerant inlet port 6 and the refrigerant outlet 7 are established among the edges of a tank longitudinal direction (drawing 1 longitudinal direction). This covering device material 30 carries out press forming of the single-clad material which carried out the clad of the wax material only to that medial surface, and is fabricated by the bowl-like configuration. And the covering device material 30 is fitted into the external surface side of a tank longitudinal direction edge, the covering device material 30 is soldered at the tank longitudinal direction edge using the wax material of the medial surface of the covering device material 30, and opening of a tank longitudinal direction edge is blockaded.

[0075] Next, drawing 13 - drawing 15 show the example of structure of the piping joint block section, it is joined to a tank longitudinal direction edge like the covering device material 30 mentioned above, and the covering device material 31 of drawing 14 carries out press forming of the double clad material which carried out the clad of the wax material to both sides. As shown in drawing 14 , the tank section 8, the refrigerant inlet port 6 open for free passage, and the tank section 13 and the refrigerant outlet 7 open for free passage are established in this covering device material 31.

[0076] As it consists of raise in basic wages material of A No. 3000 system which is not carrying out the clad of the wax material and is shown in drawing 15 , the middle plate member 32 is making the refrigerant inlet port 6, entrance-side opening 32a open for free passage and the refrigerant outlet 7, and outlet side opening 32b open for free passage penetrate, and is projecting and fabricating lobe 32c aslant from the part of entrance-side opening 32a.

[0077] The body member 33 of joint is joined to the middle plate member 32. This body member

33 of joint consists of single-clad material which carried out the clad of the wax material only to that medial surface. It applies to the body member 33 of joint at the point of lobe 32c from the part of entrance-side opening 32a of the middle plate member 32, wrap semicircle tubed path formation section 33a is formed in the shape of a bowl, and end-connection 33b is carrying out opening to the point of this path formation section 33a. Moreover, from the plate surface, to the joint covering member 33, outlet side opening 32b of the middle plate member 32 and body 33c open for free passage project, and are fabricated.

[0078] End-connection 33b is connected to the outlet section of the refrigerant decompressed by the expansion valve, and body 33c is connected to the inlet-port section of the gas refrigerant temperature sensor of an expansion valve.

[0079] While three persons of the covering device material 31, the middle plate member 32, and the body member 33 of joint are joined to one by soldering by the above configuration, it is the piping pitch P1 of the tank section 8, the refrigerant inlet port 6 by the side of 13, and the refrigerant outlet 7. It compares and is the piping pitch P2 by the side of an expansion valve. When small, it is this piping pitch P1 and P2. It can consider as the configuration which can absorb a gap.

[0080] Next, drawing 16 (a), (b), and (c) illustrate three concrete gestalten of the free passage hole 18 mentioned above. The free passage hole 18 of drawing 16 (a), (b), and (c) consists of burring holes (hole configuration with the printing section) which were able to be made in the central partition section (bending section) 16 of the tank sections 10 and 11 of the upper part formed by each bending the sheet metal material made from aluminum of one sheet.

[0081] Drawing 17 illustrates the concrete formation approach of the free passage hole 18, and as shown in drawing 17 (a), it forms punching hole 34b with the magnitude which can insert the printing section of burring hole 34a and this burring hole 34a in the sheet metal material 34 made from aluminum which constitutes the upside tank sections 8, 10, 11, and 13 first by press working of sheet metal.

[0082] Next, as shown in drawing 17 (b), the part which pierced with burring hole 34a and formed hole 34b is bent in the shape of U character. Next, as shown in drawing 17 (c), the printing section of burring hole 34a is pierced, and it inserts in hole 34b. Next, as shown in drawing 17 (d), the tip of the printing section of burring hole 34a is closed to a periphery side. Thereby, the return of the insertion condition of the printing section of burring hole 34a can be prevented, and formation of the free passage hole 18 can be completed.

[0083] Drawing 18 illustrates the structure with a group of the 1st - the 6th throttle plate 51-56, and the slit slot 36 for each 51 to throttle plate 56 insertion is formed in the location of arbitration at the lower tank sections 9 and 12. As an example of the quality of the material of each throttle plates 51-56, the double clad material which carried out the clad of the wax material (A No. 4000 system) is used for both sides of a core material (A No. 3000 system). And each throttle plates 51-56 are soldered in the lower tank sections 9 and 12 using the wax material of both sides of each throttle plates 51-56, and the wax material of the tank inside by inserting each throttle plates 51-56 in the slit slot 36 on the position.

[0084] If the advantage by the manufacture approach mentioned above is described below, after forming ** tank sections 8-13 with tubes 2-5 and another object At the same time it thickens board thickness of the sheet metal material 34 which constitutes the tank sections 8-13 and raises reinforcement, since it joins to one about tubes 2-5 The board thickness can be made sufficiently thin, detailed-ization of tubes 2-5 and the corrugated fin 19 can be advanced, and miniaturization of a refrigerant evaporator and high performance-ization can be attained by things.

[0085] ** Since the tank sections 8-13 can be constituted from bending processing of the sheet metal material 34 made from aluminum of one sheet, it becomes unnecessary to attach wax material to the external surface side of the sheet metal material 34, and the corrosion resistance of the tank section can be improved.

[0086] ** Also in tubes 2-5, since it is not necessary to attach wax material to an external surface side, corrosion resistance can be improved. Moreover, in order not to attach wax material to the external surface side of tubes 2-5, formation of a surface treatment layer

becomes good and wastewater nature improves. Moreover, the stinking thing generating suppression effectiveness in a refrigerant evaporator becomes high with improvement in wastewater nature.
[0087] ** In order not to attach wax material in the corrugated fin 19 section, formation of a surface treatment layer becomes good. Consequently, improvement in wastewater nature and improvement in the stinking thing generating suppression effectiveness can be demonstrated like the above-mentioned **.
[0088] (The 2nd operation gestalt) Although the 1st operation gestalt showed the example which installs an evaporator 1 in an air-conditioning unit case at an abbreviation perpendicular, also when leaning and installing an evaporator 1 like the 2nd operation gestalt shown in drawing 19 (the tilt angle theta to the level line C is about 10 degrees or more), this invention can be applied and the same effectiveness as the 1st operation gestalt is acquired. In addition, the concrete configuration of an evaporator 1 is the same as that of the 1st operation gestalt.
[0089] As opposed to drawing 20 showing the 3rd operation gestalt and arranging the refrigerant inlet port 6 and the refrigerant outlet 7 with the 1st operation gestalt in the upper part on the left-hand side of an evaporator 1 (The 3rd operation gestalt) With this operation gestalt, it is arranged at the left-hand side lower part, and the refrigerant inlet port 6 is open for free passage on the left-hand side of the lower entrance-side tank section 9, and, specifically, the refrigerant inlet port 6 and the refrigerant outlet 7 are opening the refrigerant outlet 7 for free passage on the left-hand side of the lower outlet side tank section 12.
[0090] With arrangement modification of this refrigerant inlet port 6 and the refrigerant outlet 7, diaphragms 14 and 15 are arranged in the lower tank section 9 and 12, and the free passage hole 18 is also formed in the lower bridgewall 17. Moreover, one throttle plate 51 is installed by this example between the refrigerant inlet ports 6 and diaphragms 14 in the lower entrance-side tank section 9.
[0091] According to the configuration of this operation gestalt, first, the refrigerant which flowed from the refrigerant inlet port 6 is distributed to a tube 2, it flows a tube 2 upwards like an arrow head m, flows [it flows in the lower-tank section 9, and] into the upside tank section 8, and results in the tank section 10 further. After that, a refrigerant is distributed to a tube 3, flows this tube 3 below like an arrow head n, and flows in the lower tank section 9. And a refrigerant passes through the free passage hole 18, shifts to the refrigerant outlet side heat exchanger Y from the refrigerant entrance-side heat exchanger X, and flows in the lower-tank section 12 of the air upstream.
[0092] Next, a refrigerant is distributed to a tube 5 from this lower-tank section 12, and a tube 5 is flowed upwards like an arrow head o, and it flows into the upper-tank section 11, and results in the tank section 13 further. Next, a refrigerant is distributed to a tube 4 and flows this tube 4 below like an arrow head p. The appropriate back, the refrigerants from a tube 4 gather within the lower-tank section 12, and flow out of the refrigerant outlet 7 into the exterior of an evaporator 1.
[0093] Here, when a refrigerant is distributed to a tube 4, liquid cooling intermediation flows in in the tube 4 on the right-hand side of drawing 20 mostly with gravity, and distribution of liquid cooling intermediation becomes an ununiformity. Then, distribution of the liquid cooling intermediation of a tube 2 located in the air flow downstream of a tube 4 can equalize the temperature distribution of the air which passes the tube 2 located before and after air flow direction A, and a tube 4 by adjusting the liquid cooling intermediation distribution in a tube 2 by restriction 51a so that it may become the liquid cooling intermediation distribution in a tube 4, and reverse.
[0094] On the other hand, when a refrigerant is distributed to a tube 3, liquid cooling intermediation flows in in the tube 3 on the left-hand side of drawing 20 mostly with gravity, and distribution of liquid cooling intermediation becomes an ununiformity. Then, by setting up suitably the opening area of two or more free passage holes 18, and arrangement, the refrigerant distribution in a tube 5 can be adjusted and the temperature distribution of the air which passes the tube 3 located before and after air flow direction A and a tube 5 can be equalized.
[0095] (Other operation gestalten) Although three restriction 51a-56a was formed in the

entrance-side tank section 9 and the outlet side tank section 12 with the above-mentioned 1st operation gestalt, respectively, according to the refrigerant distribution property demanded, restriction is good as for one, and it is good as for two or more. Moreover, the configuration of restriction 51a-56a can set up an ellipse, a rectangle, etc. variously.

[0096] Moreover, although between the two tank sections 10 and 11 was made to open for free passage with the above-mentioned 1st operation gestalt in the free passage hole 18 established in the bridgewall 16, the member which has a side refrigerant path can be added to an evaporator side face (R> drawing 1 1 right lateral) instead of the free passage hole 18, and between the two tank sections 10 and 11 can also be made to open for free passage by the side refrigerant path.

[0097] Moreover, in the above-mentioned operation gestalt, the refrigerant entrance-side heat exchange section X may be arranged to the air flow upstream, and the refrigerant outlet side heat exchange section Y may be arranged to the air flow downstream.

[0098] Moreover, with the above-mentioned operation gestalt, although two trains of heat exchange sections X and Y have been arranged to air flow direction A, this invention can apply the heat exchange sections X and Y also to the refrigerant evaporator arranged three or more trains to air flow direction A.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the outline perspective view of the refrigerant evaporator by the 1st operation gestalt of this invention.
[Drawing 2] It is the outline perspective view showing the lower-tank section of drawing 1 .
[Drawing 3] It is the property Fig. which measured the outlet air temperature of the tube 4 of drawing 1 .
[Drawing 4] It is drawing showing the opening surface ratio of the restriction of drawing 1 , and the relation of the air conditioning engine performance.
[Drawing 5] It is the side elevation showing the end-face configuration of the tank section of drawing 1 .
[Drawing 6] The explanatory view of the example of the quality of the material of a tube and (c of the sectional view in which (a) shows the cross-section configuration of the tube of drawing 1 , and (b)) are the explanatory views of wax material spreading to a tube configuration member.
[Drawing 7] It is the sectional view of the fitting section of the tank section of drawing 1 , and a tube.
[Drawing 8] (a) — the top view of the tube edge of drawing 1 , and (b) — the front view of a tube edge, and (c) — a part of (b) — it is an approximate account Fig. in the condition with a group that an enlarged drawing and (d) inserted the tube edge in the expansion perspective view of (a), and (e) inserted it in the tank section.
[Drawing 9] It is the sectional view showing other examples of the fitting section of the tank section of drawing 1 , and a tube.
[Drawing 10] It is the explanatory view of wax material spreading on the corrugated fin of drawing 1 .
[Drawing 11] It is an expansion perspective view in the decomposition condition of the diaphragm section of drawing 1 .
[Drawing 12] It is the perspective view of the covering device material of the tank section of drawing 1 .
[Drawing 13] It is the perspective view of the piping joint section of drawing 1 .
[Drawing 14] It is the perspective view of the covering device material in the piping joint section of drawing 13 .
[Drawing 15] (a) is [the B-B sectional view of (a) and (c of the front view of the piping joint section of drawing 13 and (b))] the front views of a middle plate member.
[Drawing 16] It is the sectional view of the free passage hole of drawing 13 .
[Drawing 17] It is the sectional view for explanation of the formation approach of the free passage hole of drawing 13 .
[Drawing 18] It is the decomposition perspective view showing the attachment structure of the throttle plate of drawing 2 .
[Drawing 19] It is the perspective view showing the installation condition of the refrigerant evaporator by the 2nd operation gestalt of this invention.
[Drawing 20] It is the outline perspective view showing the refrigerant path configuration of the refrigerant evaporator by the 3rd operation gestalt of this invention.

[Drawing 21] It is the outline perspective view showing the refrigerant path configuration of the conventional evaporator.
[Drawing 22] It is the sectional view of the evaporator of drawing 21 .
[Description of Notations]
2-5 [— The tank section, 9b, 12b / — A distribution tank part, 51a-56a / — Restriction.] — A tube, 6 — A refrigerant inlet port, 7 — A refrigerant outlet, 8-13

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
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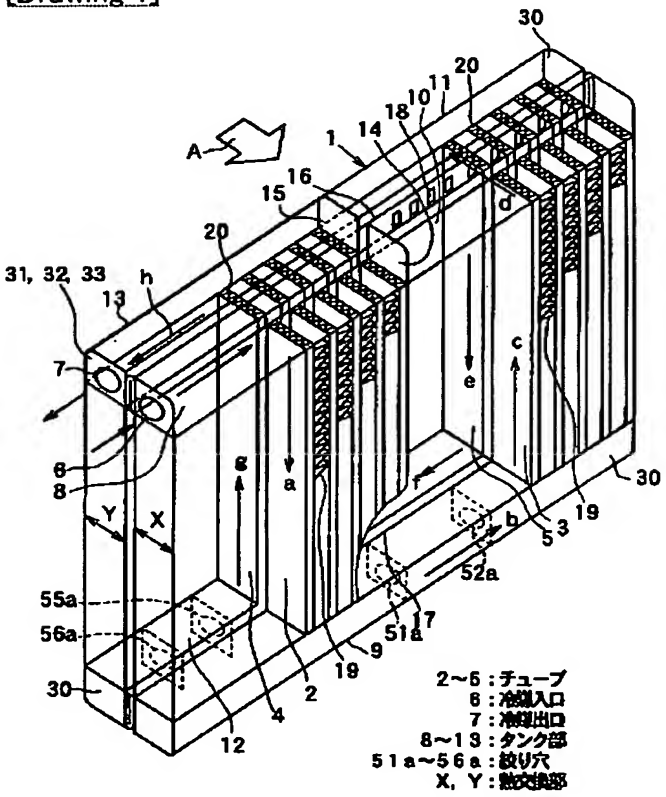
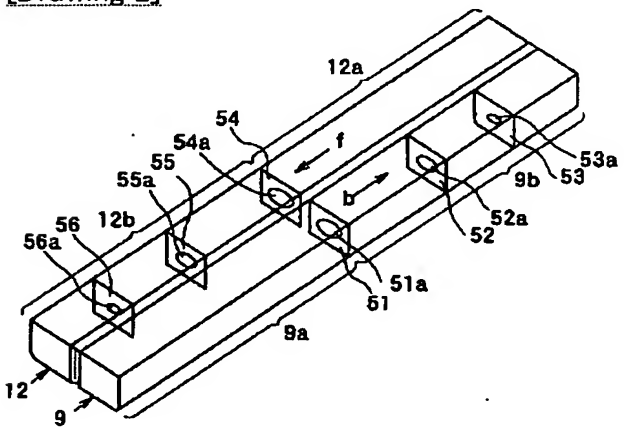
DRAWINGS

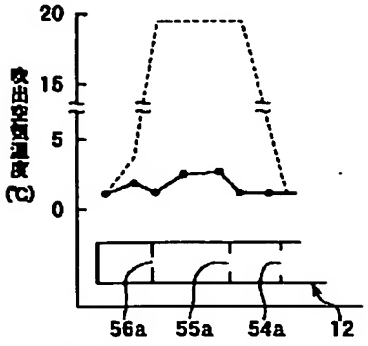
[Drawing 1]



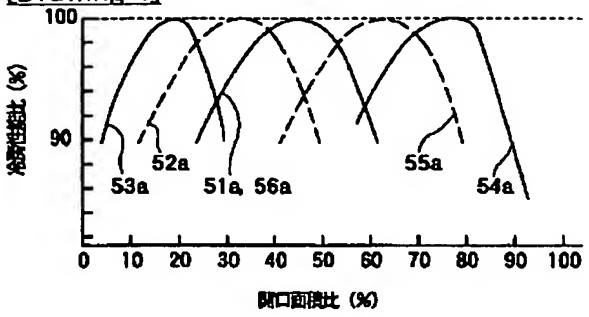
[Drawing 2]



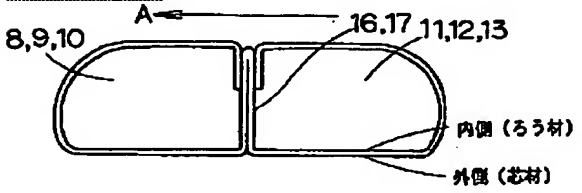
[Drawing 3]



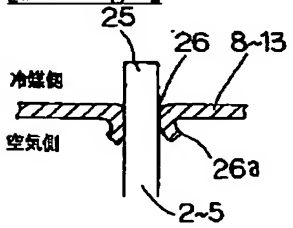
[Drawing 4]



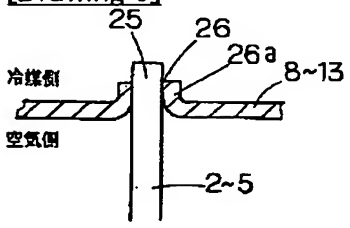
[Drawing 5]



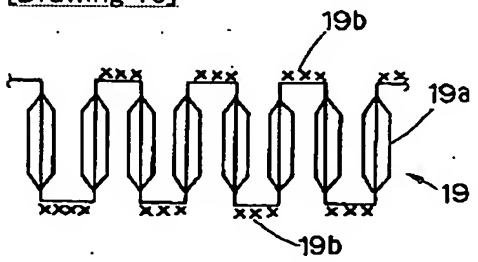
[Drawing 7]



[Drawing 9]



[Drawing 10]



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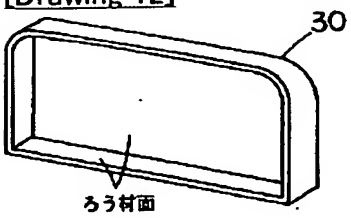

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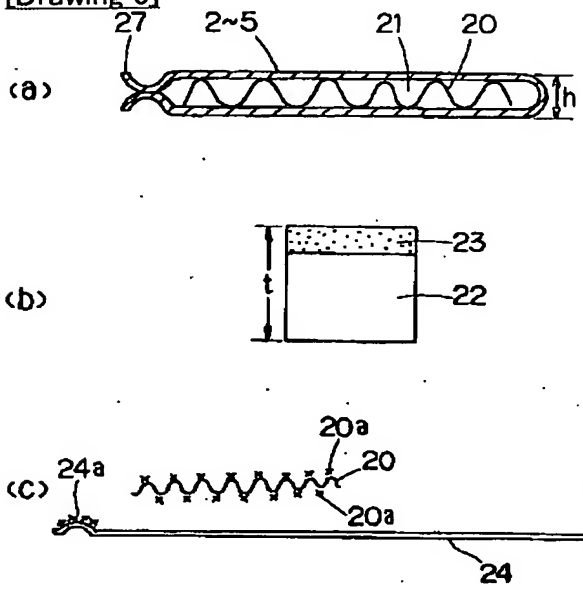

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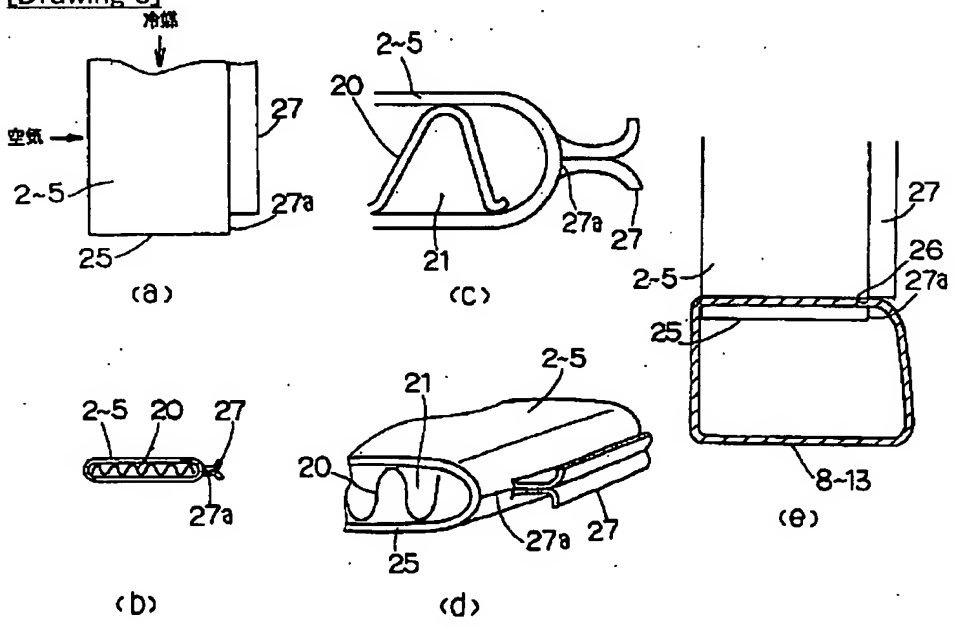

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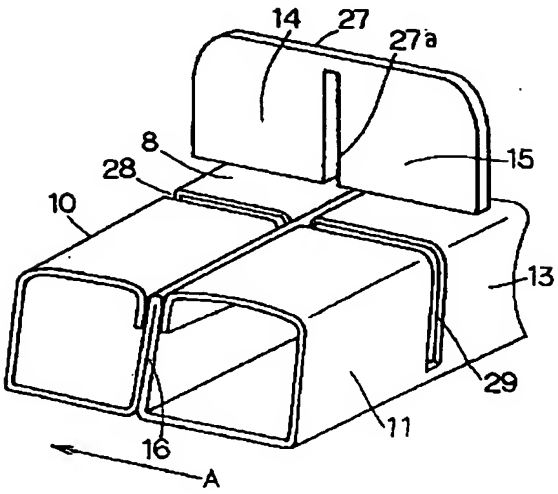

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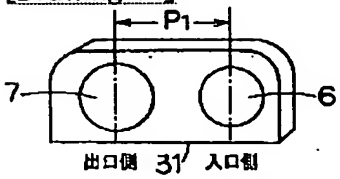
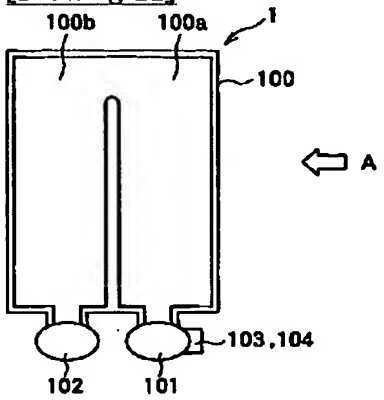
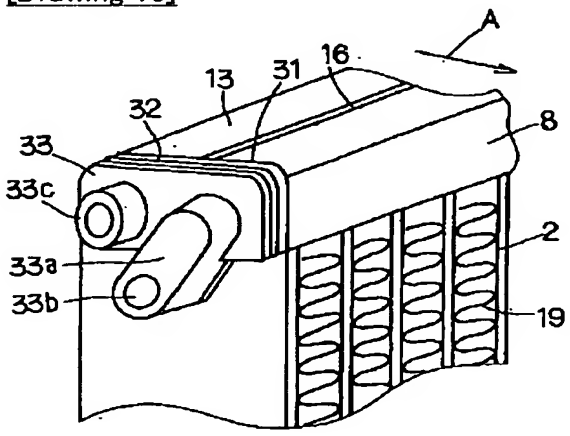


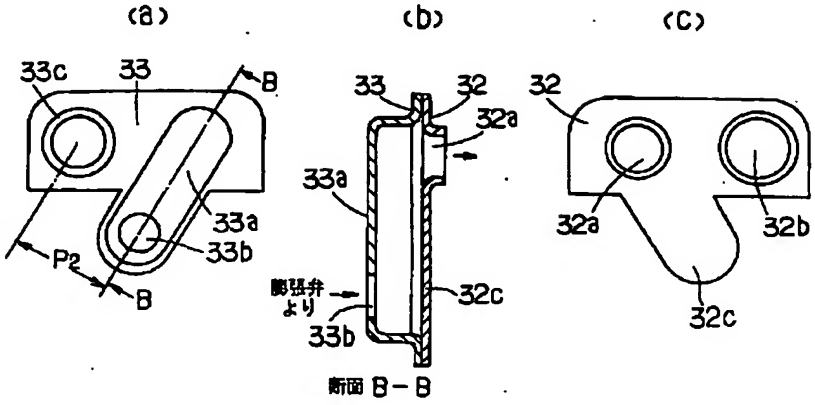
[Drawing 22]



[Drawing 13]



[Drawing 15]



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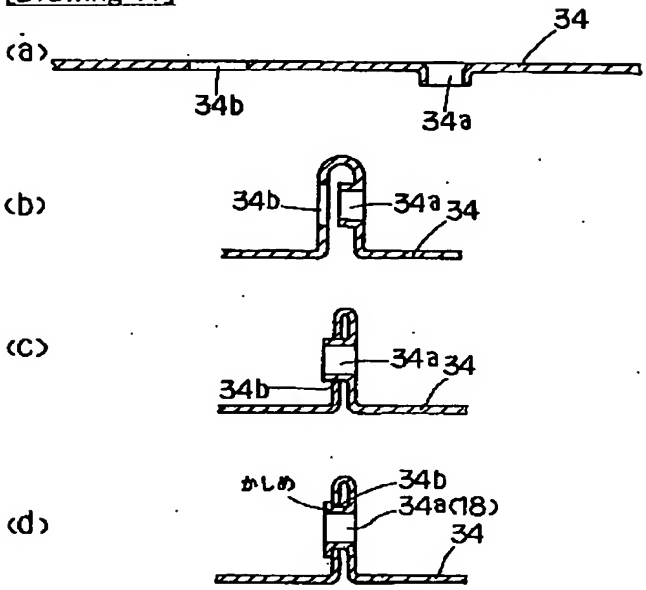
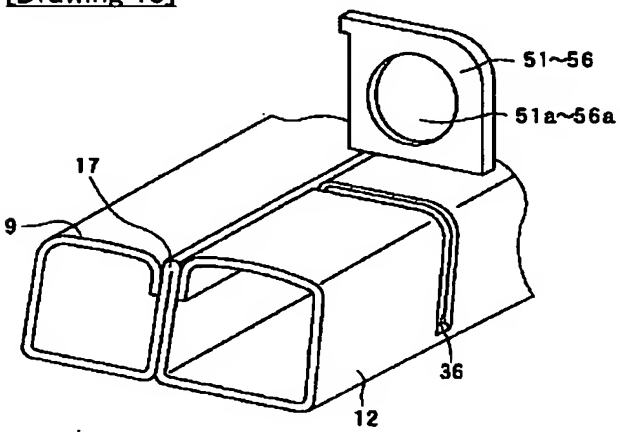
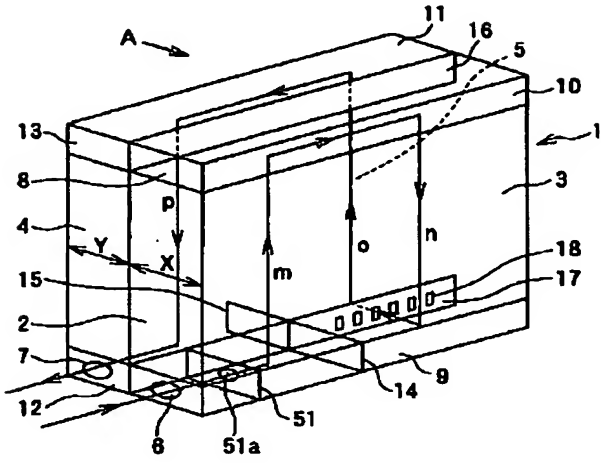


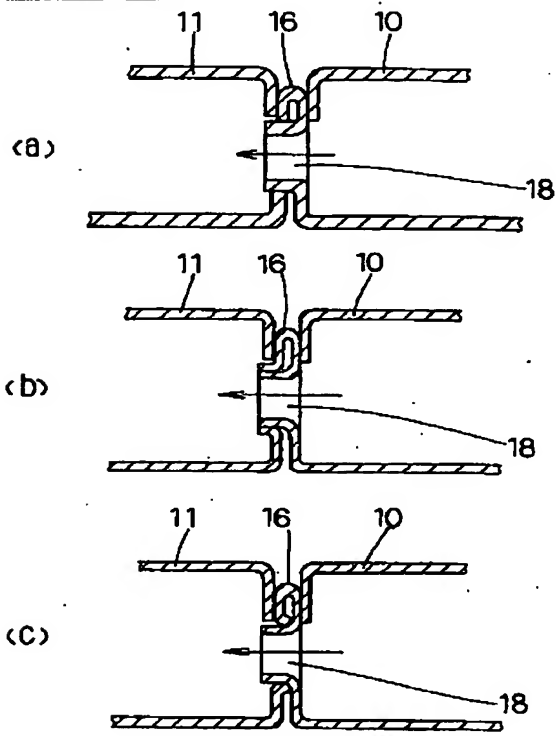
[Drawing 18]



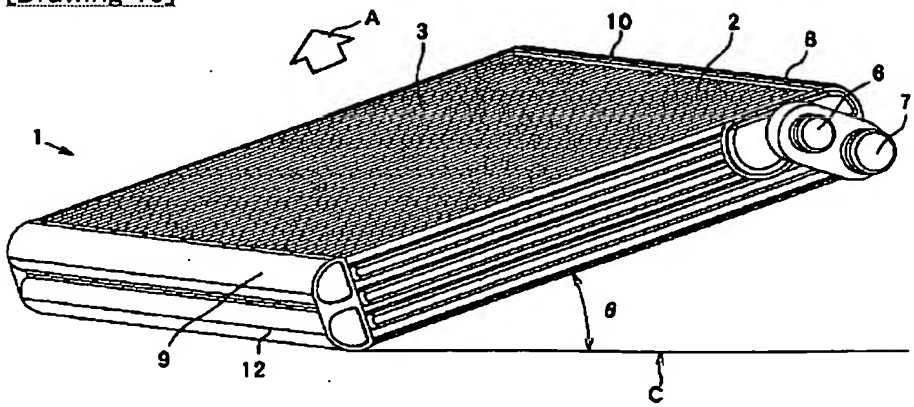
[Drawing 20]



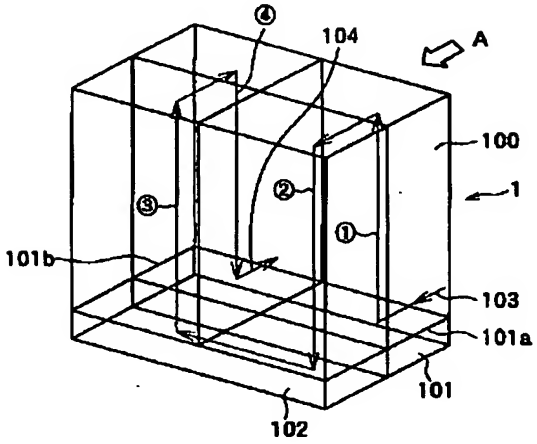
[Drawing 16]



[Drawing 19]



[Drawing 21]



[Translation done.]